TANDBERG

3400X 3500X 3600XD
SERVICE MANUAL

Tandberg RADIO

CONTENTS

		Page
1.	**Introduction**	3
1.1	General	3
1.2	Removing the top panel	3
2.	**Maintenance**	4
2.1	Cleaning the tape path	4
2.2	Lubrication	4
3.	**Mechanical checks and adjustments**	5
3.1	Checking the take-up force and winding force	5
3.2	Adjusting the take-up force	5
3.3	Adjusting the winding force	6
3.4	Adjusting the brakes	8
3.5	Rubber drive belt	8
3.6	Pressure pad arm	9
4.	**Tape path**	10
4.1	Capstan	10
4.2	Head parallelism	10
4.3	Tape guide posts and guide screws	11
4.4	Pinch roller	11
4.5	Flutter roller	12
5.	**Head alignment with Tandberg test tapes, four tracks**	13
5.1	Playback head	13
5.2	Record head	13
5.3	Height adjustment by track measurement	13
5.4	Bias head	14
5.5	Erase head	14
6.	**Head alignment without Tandberg test tapes, four tracks**	15
6.1	Playback head	15
6.2	Record head	15
6.3	Bias head	15
6.4	Erase head	15
6.5	Aligning the hum shield for the playback head	15
7.	**Head alignment, two tracks**	16
7.1	Playback head	16
7.2	Record head	16
7.3	Erase head	17
8.	**Circuits**	17
8.1	Oscillator	17
8.2	Photo end-stop	17
8.3	Record and playback frequency responses	18
8.4	Fault in the total response curve, one channel	19
9.	**Modifications**	20
9.1	Changing the line voltage and frequency	20
9.2	Changing from four tracks to two tracks version	20
10.	**Block diagrams**	20
11.	**Electrical adjustments**	22
11.1	Output amplifiers (3400X)	22
11.2	Dolby* level adjustments (3600XD)	22
11.3	Adjustments, all models	23
	Circuit diagrams	from page 24

** The word Dolby is a Trade Mark of Dolby Laboratories Inc., USA*

1. INTRODUCTION

1.1 GENERAL

Only LH (Low Noise/High Output) tape should be used for recording. Make sure that the heads and tape path are clean.

To check the heads:

1. Remove the front head cover by depressing the spring loaded buttons at both ends and lifting the cover straight upwards.
2. Remove the back cover by depressing the spring on its rear side and lifting straight upwards.

When electrical adjustments are to be made, the bottom panel must be removed.

The tape path must be degaussed both before and after adjustment. Do not switch off the degausser until it is about 3 feet from the tape path.

To make magnetized parts of the tape visible, dip the tape in "Magna See". This is a mixture of iron oxide powder and alcohol. Iron oxide powder can be obtained from our service department.

NOTE! All paragraphs in this manual are valid for:
Model 3400X, from serial No. 4300 000
Model 3500X, all decks
Model 3600XD, from serial No. 4200 000

1.2 REMOVING THE TOP PANEL

Remove the head covers and the speed selector knob. Then remove the screws as shown in Figure 1.1. Removal of the top panel will usually only be necessary for checking and adjustment of clutches and other parts in the drive mechanism.

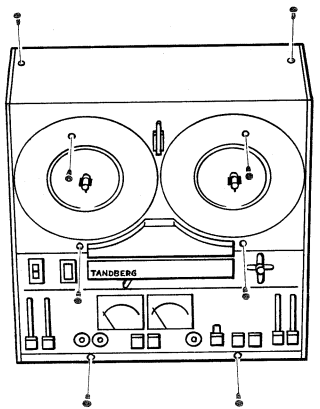


Fig.1.1. Top panel screws

2. MAINTENANCE

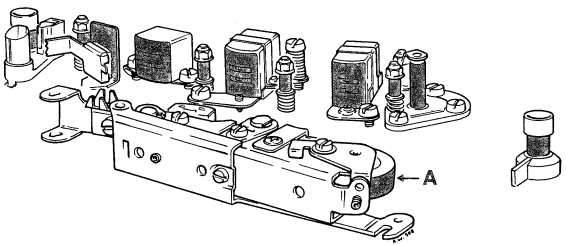


Fig. 2.1 Cleaning the tape path

2.1 CLEANING THE TAPE PATH

It is important that the tape path is clean before adjustments are made. If the heads and guide posts have been adjusted, the tape path must be demagnetized.

Cleaning should be carried out with cotton-bud sticks (Q-tips) moistened with *pure alcohol or methylated spirit.* A special cleaning kit called "Tandberg Professional Tape Head Cleaner" is also available.

Aerosol sprays indented for video tape recorders may be used, but it is not sufficient just to spray the parts; cotton-bud sticks must also be used.

Obstinate deposits on guide posts should be first well softened with the cleaning agent and then removed with the aid of a toothpick.

The pinch roller A should be cleaned if the tape runs unevenly or if there are visible deposits on the roller (4 to 6 times a year should be sufficient, even if the tape recorder is much used). Make sure that the pinch roller is dry after cleaning.

2.2 LUBRICATION

NOTE! Do not use more than one drop of oil on each bearing, as excessive oil may penetrate into the drive mechanism and disturb friction conditions.

The turntables, flywheel and transfer wheel are mounted in self-lubricating bearings and should not need attention under normal conditions. If for some reason lubrication appears to be necessary, use Teresso oil No 43 or 47 from Esso.

The motor should be lubricated after every 3000 hours of operation. Apply only one drop of Teresso oil No. 43 or 47 from Esso.

3. MECHANICAL CHECKS AND ADJUSTMENTS

3.1 CHECKING THE TAKE-UP FORCE AND WINDING FORCE

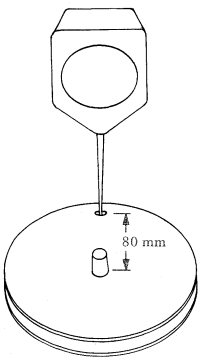


Fig. 3.1 Checking the winding force.

A 7" reel with a hole drilled in it 80 mm from the hub hole is required together with a torque gauge. Insert the leg of the torque gauge into the drilled hole. The reel should be allowed to rotate slowly in the direction of the clutch torque while the measurements are performed to obtain the specified values, see table 3.2.

Turntable	Operating lever position	Playback or wind force
Right	▶	25– 30 g*
Right	▶▶	90–250 g*
Left	◀◀	90–250 g*

Table 3.2 Clutch torque

* It is normal for the winding force to increase 20-30% after the machine has been in continuous operation for some time.

3.2 ADJUSTING THE TAKE-UP FORCE

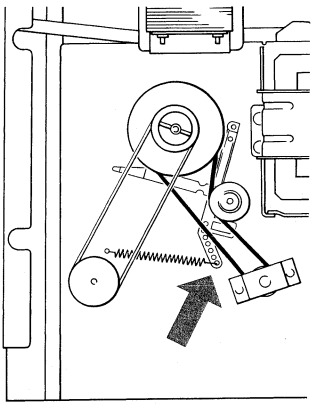


Fig. 3.3 Adjusting the take-up force.

NOTE! Do not touche the textile side of the belt with your fingers.

The rubber drive belt does not move during normal forward drive. This is because a textile belt provides the take-up force via a drive wheel mounted behind the take-up turntable.

Adjust the take-up force by moving the spring, see Figure 3.3.

If the winding force is not correct it should be adjusted as explained on the next page.

3.3 ADJUSTING THE WINDING FORCE

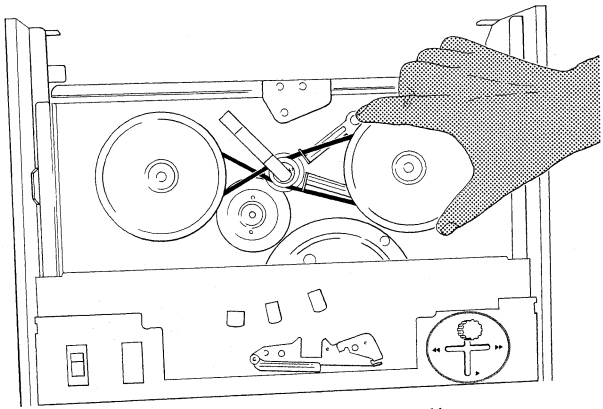


Fig. 3.4 Checking the play on the turntables

Adjusting the reel turntables.

The winding force is determined by the springs A. See Figures 3.5 and 3.7. If the tension and the springs do not change, the winding force is determined by the play on the reel turntable and the clutch leaver. If the tension is still not correct after adjusting the play, replace the spring A.

With the joystick in the FREE position, the play on the turntable should be between 0.5 and 1 mm as shown in Figure 3.4. The play on the left turntable can be adjusted by turning the nut on the turntable spindle. The play on the right turntable can be adjusted by turning the turntable pulley.

NOTE! If the turntable pulley (right turntable) must be unscrewed from the turntable it should be glued into position after the play has been adjusted.

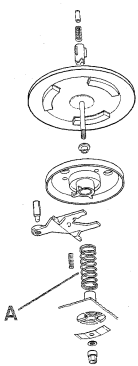


Fig. 3.5 The supply turntable

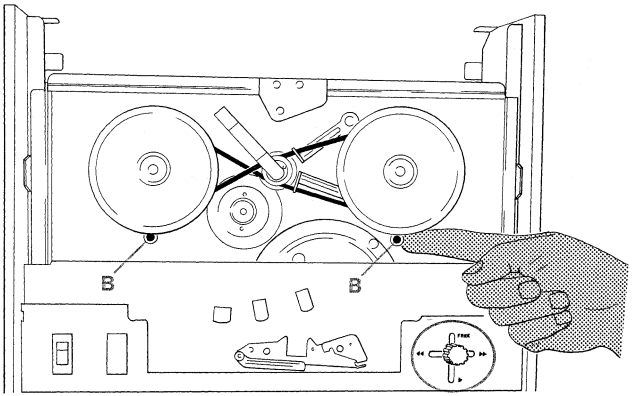


Fig. 3.6 Checking the play on the clutch levers

Adjusting the clutch lever.

With the joystick in the NEUTRAL (middle) position, the play on the clutch levers, right and left, should be between 0.5 and 1 mm.
To adjust this play, turn the screws B shown in Figure 3.6.

When the play on the turntable and the clutch levers has been adjusted, the winding forces will be correct. Check these forces with the aid of the table on page 5. Adjusting the brakes – see next page.

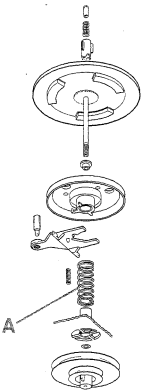


Fig. 3.7 The take-up turntable

3.4 ADJUSTING THE BRAKES

This adjustment procedure is the same for both turntables, but referende is made to the right turntable. See Figure 3.8.

Set the joystick to the ▶ position. Check that the clearance between the brake pad and the turntable is 1 mm (0.4") approx. If necessary adjust screw D. Set the joystick to ◀◀ , alternatively ▶▶ and check the clearance.

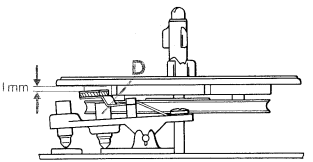


Fig.3.8. Adjusting the brakes on the right turntable

3.5 RUBBER DRIVE BELT

The rubber drive belt does not move in PLAY mode. This is because a textile belt provides the take-up force via a drive wheel mounted behind the take-up turntable.

When changing the drive belt, make sure that the new belt sits correctly on the motor pulley as shown in Figure 3.9. The belt must sit in the top two belt grooves and not in the same groove. The belt must not cross on the wrong side of the pulley.

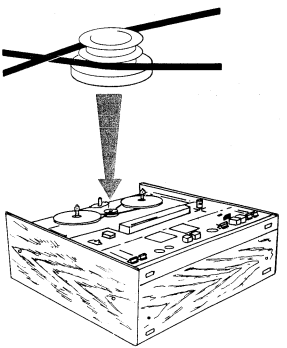


Fig. 3.9 Replacing the drive belt

The lifting arms for the drive belt should be adjusted when the joystick is in NEUTRAL (mid-position). Adjust for 1 mm clearance with flat pliers as shown in Figure 3.10. Adjust A first and the B.

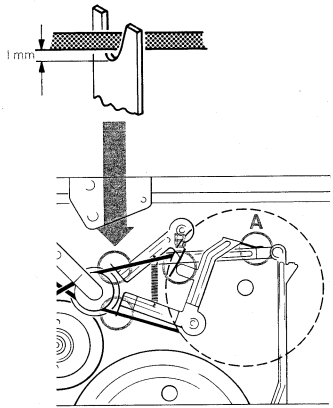


Fig.3.10. Adjusting the clearance on the drive belt

3.6 PRESSURE PAD ARM

With the joystick in the ▶ position, the tension from the pressure pad arm against the bracket should be between 80 and 100 g. This pressure should be measured as shown in Figure 3.11. Adjust by bending spring A which presses the pressure pad arm against the head. Check that the pressure pad arm is parallel when it meets the bracket.

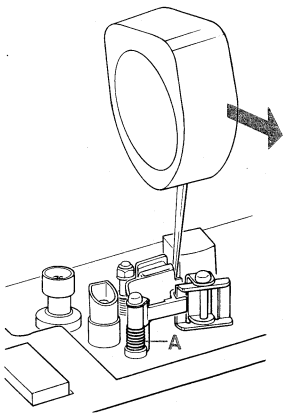


Fig.3.11. Measuring the pressure-pressure

4. TAPE PATH

4.1 CAPSTAN

Before the heads and tape guide posts are adjusted, the position of the capstan must be checked. Use special tool No. 5 as shown in Figure 4.1. All three legs of the special tool should rest on the upper mounting plate. If one or more of the legs does not rest on the plate, the capstan needs adjusting. To adjust the capstan, loosen the three coloured screws and adjust the capstan until all three legs of the tool rest on the plate. Tighten up the screws and check again that the legs are all touching the plate.

NOTE! The capstan will not go out of adjustment with normal use and transit.

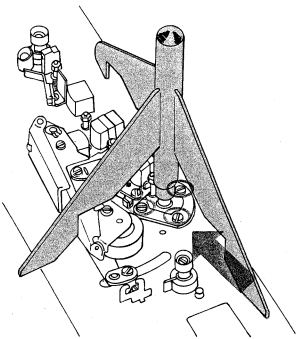


Fig. 4.1. Adjusting the capstan with special tool No. 5.

4.2 HEAD PARALLELISM

Check that the heads are parallel with the aid of a tape path gauge, see Figure 4.2. This adjustment affects the passage of the tape through the tape path, and where the heads are seriously out of alignment the complete tape path must be checked, see next page.

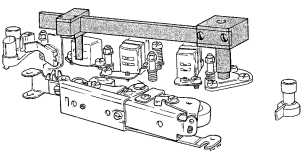


Fig. 4.2. Adjusting with the tape path gauge.

Adjust Forwards | Adjust Backwards | Correct Zenith

4.3 TAPE GUIDE POSTS AND GUIDE SCREWS

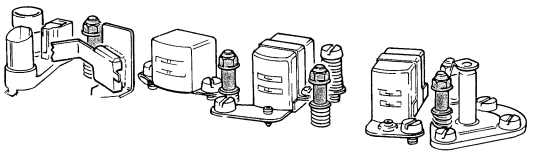


Fig. 4.3. Adjustable tape guide posts.

Thread a tape into the tape path. Pull the joustick slowly down into the ▶ position and tighten the tape by rotating the left reel slowly clockwise.

Check that the tape does not come into contact with the edges of the tape guide screws. If necessary, adjust the guide screws shown in Figure 4.3.

When the machine is in the playback mode and tape is passing the heads, the tape may touch the top edges of the guide posts and guide screws, but under no circumstances should it twist or distort.

4.4 PINCH ROLLER

The two adjustments possible on the pinch roller are parallelism and azimuth.

Parallelism.

Push the pressure roller arm in and check that the pinch roller is parallel with the capstan. To adjust, loosen screw A and adjust screw B (Figure 4.4) until the pinch roller and capstan are parallel. Tighten up screw A.

Azimuth.

Put a tape into the tape path and move the joystick to ▶. Check that the tape does not distort when it has passed the pinch roller. To adjust, loosen screw A and move bracket C (Figure 4.4) until the tape runs properly. Tighten up screw A.

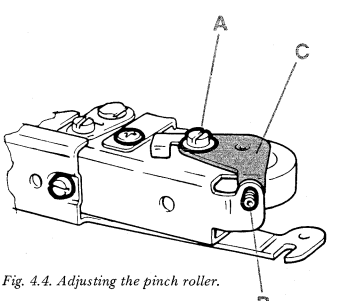


Fig. 4.4. Adjusting the pinch roller.

4.5 FLUTTER ROLLER

Parallelism.

Loosen screw A (Figure 4.5). Insert a screwdriver into the slot and move the upper bearing forwards or backwards until the flutter roller is parallel with the head front.

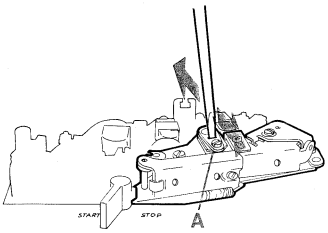


Fig. 4.5. Adjusting the parallelisem of the flutter roller.

Azimuth.

Set the speed selector to 7½ ips, put a tape into the tape path, and move the joystick to ▶ . Insert a screwdriver as shown in Figure 4.6 and twist it to move the flutter roller to the left until the tape just touches the top edge of the nearest tape guide post.

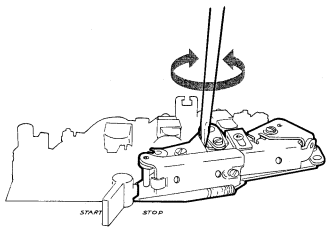


Fig. 4.6. Adjusting the azimuth of the flutter roller.

Move the screwdriver to the position shown in Figure 4.7 and move the flutter roller carefully to the right. If the roller is correctly adjusted the tape will lift slowly upwards from the bottom part of the tape guide post and touch the upper part of the tape guide post without curling.

This adjustment can be checked with a lamp placed behind the tape path. Look from the front to see light between the tape and the lower part of the tape guide post.

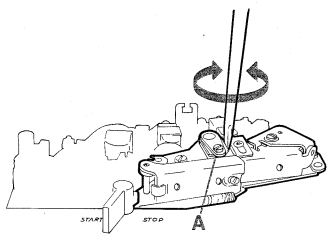


Fig. 4.7. Adjusting the azimuth of the flutter roller.

5. HEAD ALIGNMENT WITH TANDBERG TEST TAPES, FOUR TRACK

NOTE!

The tape path must be thoroughly cleaned before adjustments are carried out. Use tape without any defects. **If the heads have grooves caused by wear, adjustment of the heads should be avoided.**

Seal all screws in the tape path after the adjustments have been made.

After replacement of a single part in the tape path, it may often be necessary to adjust the new part only. If, however, more parts have to be adjusted, a complete check and adjustment of the entire tape path must be performed. Adjustments must be carried out in the same sequence as explained in this section.

5.1 PLAYBACK HEAD

Connect an a.c. voltmeter to each of the LINE OUT sockets and set the SOURCE/TAPE buttons to TAPE.

Height adjustments

Play back test tape No. 1. This is a full track pre-recorded tape with 1,000 Hz recorded at 7½ ips and with the area corresponding to track 3 reduced by approximately 35 dB. Adjust the height of the playback head by means of screw A, Figure 10.1, page 21 until minimum output is obtained from track 3, channel R while maintaining the head-front parallel to the tape.

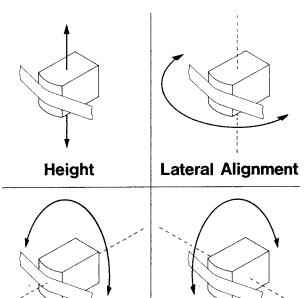
Azimuth adjustments

Play back Tandberg test tape No. 2 at 7½ ips (or a standard azimuth tape). Adjust the azimuth position of the playback head by means of screw B, Figure 10.1 (page 21) until maximum output on the voltmeters is obtained on both channels, or adjust for the best compromise.

5.2 RECORD HEAD

Height adjustment by visual inspection

Insert a new tape and set the deck to normal forward drive (▶). Check visually that the tape appears to run parallel with the upper track on the record head, within approximately 0.1 mm (0.04") see Figure 5.1. If necessary adjust the height with screws C, Figure 10.1, while maintaining the head-front parallel with the tape.



5.3 HEIGHT ADJUSTMENT BY TRACK MEASUREMENT

Record in stereo a 1,000 Hz signal well above the normal level, first in one direction, then in the opposite direction. Cut off a length of tape and dip into a solution of fine-grained iron-oxide powder and alcohol (Magna See). The tracks will then be visible as four dark stripes. Figure 10.2 (page 21) shows the correct pattern on the tape and the patterns obtained when the head is either too high or too low. If necessary, adjust the height of the head and repeat the measurement until the patters are correct.

Azimuth adjustment

Load the deck with a new tape and record at 3¾ ips a 12 to 13 kHz signal in stereo. Set the SOURCE/TAPE buttons to TAPE. Adjust both INPUT LEVEL potentiometers for approximately 150 mV reading on a.c. voltmeters connected to the LINE OUT sockets. Adjust the screw D (figure 10.1) for maximum output from both channels, or the best compromise.

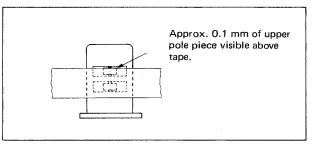


Fig. 5.1. Four track record head.

5.4 BIAS HEAD

Vertical adjustment

Move the operating lever slowly to the normal forward drive position (▶) and check that the head-front of bias and record heads are parallel. If necessary, bend the arm of the bias head as required.

Height adjustment

Set the deck to the stereo record mode, and unscrew the locking screw H (Figure 10.1) about one turn.

Connect an a.c. voltmeter across each half of the record head. Move the bias head up or down by means of adjustment screw M (Figure 10.1) for the highest possible reading on the voltmeter. Check that the tape runs freely in the groove in front of the bias head, and that there is sufficient clearance between the bias head and the mounting plate for the record head. If necessary, raise the bias head slightly. The height position of the bias head is not critical. Before tightening screw H, carry out the horizontal adjustment as follows.

Horizontal adjustment

Connect an a.c. voltmeter across each half of the record head and set the deck to the stereo record mode. Insert a screwdriver in the groove shown in Figure 5.2 and tilt the bias head to the right. Then tilt the bias head carefully by means of the screwdriver towards the left until the induced voltage (bias) in the record head increases to a maximum.

Continue tilting the head towards the left until the induced voltage (bias) in the record head is reduced to between 10 and 15% below maximum. Tighten screw H while maintaining the correct horizontal position for the head. Then re-check the output voltage. If the voltage has changed noticeable, the horizontal adjustment procedure must be repeated.

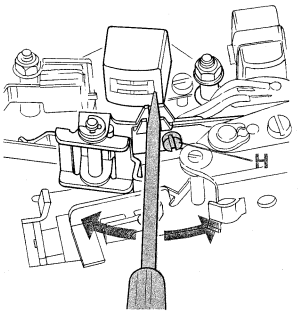


Fig. 5.2. Horizontal adjustment for the bias head.

5.5 ERASE HEAD

Height adjustment

By visual inspection, check that approximately 0.25 mm (0.01") of the upper half of the erase head is visible above the tape, see Figure 5.3. Insert Tandberg test tape No. 9 and record on channel R a 400 Hz signal well above normal recording level. Dip the tape in a solution of fine-grained iron-oxide powder and alcohol (Magna See). Check that the recorded track is positioned in the centre of the erased track, see Figure 10.3, page 21.

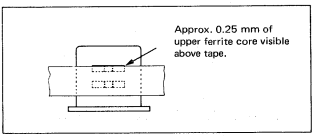


Fig. 5.3. Four track erase head.

6. HEAD ALIGNMENT WITHOUT TANDBERG TEST TAPES, FOUR TRACK

6.1 PLAYBACK HEAD

Height adjustment

Adjust the height of the playback head by means of the screws A, Figure 10.1, page 21. The upper edge of the tape shall run flush with the upper part of the head lamination for channel L. See Figure 6.1.

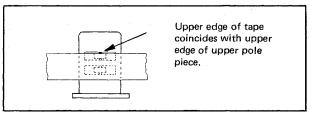


Fig. 6.1. Four track playback head.

Azimuth adjustment

Set the SOURCE/TAPE buttons to TAPE. Play back a standard azimuth alignment tape with an a.c. voltmeter connected to each LINE OUT socket. Adjust the position of the playback head by the azimuth adjustment screw B, Figure 10.1 until a maximum reading is obtained on the voltmeters.

6.2 RECORD HEAD

Follow the instructions given in Paragraph 5.3.

6.3 BIAS HEAD

Follow the instructions given in Paragraph 5.4.

6.4 ERASE HEAD

Height adjustments

Adjust the height of the erase head by means of the screws K and L, see Figure 10.1.

Approximately 0.25 mm (0,01") of the ferrite core for the upper track of the erase head should be visible above the tape, see Figure 6.2.

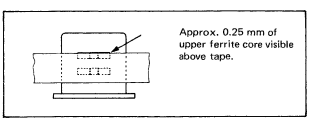


Fig. 6.2. Four track erase head.

6.5. ALIGNING THE HUM SHIELD FOR THE PLAYBACK HEAD.

The hum shield for the playback head is positioned on the pinch roller arm so that the shield is right in front of the head during playback. Set the deck to stereo playback with both SOURCE/TAPE buttons in the position TAPE without tape in the tape path. Put a piece of paper between the photoelectric end-stopsensor and the light. Set the deck to PLAY.

Connect an a.c. voltmeter to each of the LINE outputs. Hold the shield and loosen screw E (Figure 10.1) one quarter turn.

Pull the shield as far away from the head as the mounting hole permits. Adjust the shield sideways to obtain a minimum reading on both voltmeters, or best possible compromise. When adjustment is completed, tighten the screw and seal with lacquer.

7. HEAD ALIGNMENT, 2 TRACKS

7.1 PLAYBACK HEAD

Height adjustment

Adjust the height of the playback head by means of the screws A, Figure 10.1. The tape shall run parallel with the upper and lower edges of the laminations of the playback head, see Figure 7.1. If necessary, re-adjust and check the azimuth position.

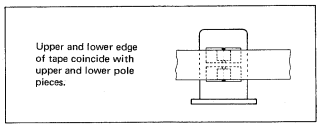


Fig. 7.1. Two track playback head.

7.2 RECORD HEAD

Height adjustment

Adjust the height of the record head by means of the screws C, Figure 10.1.

Record on channel L a 1,000 Hz signal at 7½ ips well above normal recording level, first in one direction, then in the opposite direction. Cut off a lenth of the recorded tape and dip it into a solution of fine grained iron-oxide powder and alcohol (Magna See). Check that the tracks are distributed symmetrically across the tape. See Figure 10.4, page 21. If necessary, re-adjust and check the azimuth position.

7.3 ERASE HEAD

Height adjustment

Adjust the height of the erase head by means of the screws K and L, Figure 10.1.
Adjust until equal parts of the ferrite cores are visible above and below the tape, see Figure 7.2.

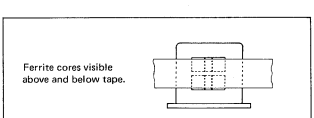


Fig. 7.2. Two track erase head.

8. CIRCUITS

8.1 OSCILLATOR

The oscillator frequency is 85.5 kHz for a stereo recording. Measure this frequency with a frequency counter on the bias head and adjust with C502 on the oscillator board.

8.1.1 Erase voltage

Prepare the machine for a stereo recording. Connect a VVM to the upper half of the erase head via a low capacity probe. Check that the voltage is between 80 and 120 V. Check that the same voltage appears across the bottom half of the head. Set the machine to record on channel L, and check that the voltage is the same on the upper half of the head. The permissable difference between the voltages on the two halves of the head from a stereo recording is 10 V max. Carry out the same check for channel R.

8.1.2 Bias current, pre-adjustment

Prepare the machine for a stereo recording, and use a VVM to measure the voltage across the upper half of the bias head. Adjust the voltage to 22 V by means of R401. Check that the voltage across the bottom half of the head is 22 V and adjust by means of R400.
Demagnetize the heads and tape path.

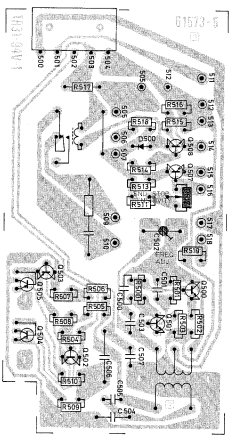


Fig. 8.1. Oscillator board.

8.2 PHOTO END-STOP

To change the lamp, take the screw out of the tape guide post, push the photo end-stop unit back, and lift it up. See Figure 8.2.

The sensitivity of the photo end-stop can be adjusted by means of R512 on the oscillator board. See Figure 8.1.

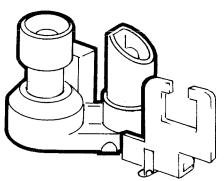


Fig. 8.2. Photo end stop.

8.3 RECORD AND PLAYBACK FREQUENCY RESPONSES

8.3.1 Record amplifier

Connect a 100 ohm resistor in series with the record head and earth as shown in Figure 8.3. Connect an audio oscillator to the LINE input of each channel and a VVM across the 100 ohm resistor. Short circuit the trimming capacitor C502 in the tape recorder oscillator. Put the machine into the stereo record mode. Set the record level to – 30 dB on the meter (30 dB below normal). This 30 dB attenuation should be obtained as follows:

10 dB with the INPUT LEVEL knobs on the machine and 20 dB with the output control on the audio oscillator.

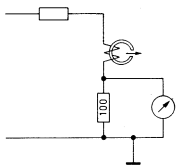


Fig. 8.3. Measuring the recording response.

Tune the audio oscillator to 400 Hz and use this for the reference level on the VVM (0 dB). Sweep the audio oscillator over the frequency range and check that the readings on the VVM correspond to the curves shown in Figure 8.4.

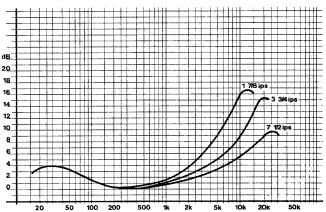


Fig. 8.4. Recording response curves.

8.3.2 Playback amplifier

Connect a 22 ohm resistor in series with the write lead on the playback head. Connect an audio oscillator in series with a 1 k ohm resistor and a 100 µF capacitor as shown in Figure 8.5. Connect a VVM to the outputs of channels L and R, and set the output selector to STEREO.

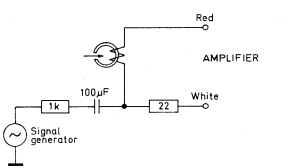


Fig. 8.5. Measuring the playback response.

Use an VVM to check the shape of the playback frequency curve. Tune the audio oscillator to 400 Hz and adjust the signal level to 75 mV measured on the LINE OUT sockets. Check that the frequency responce curves agree with Figure 8.6.

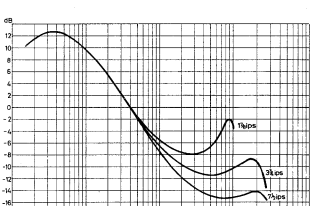
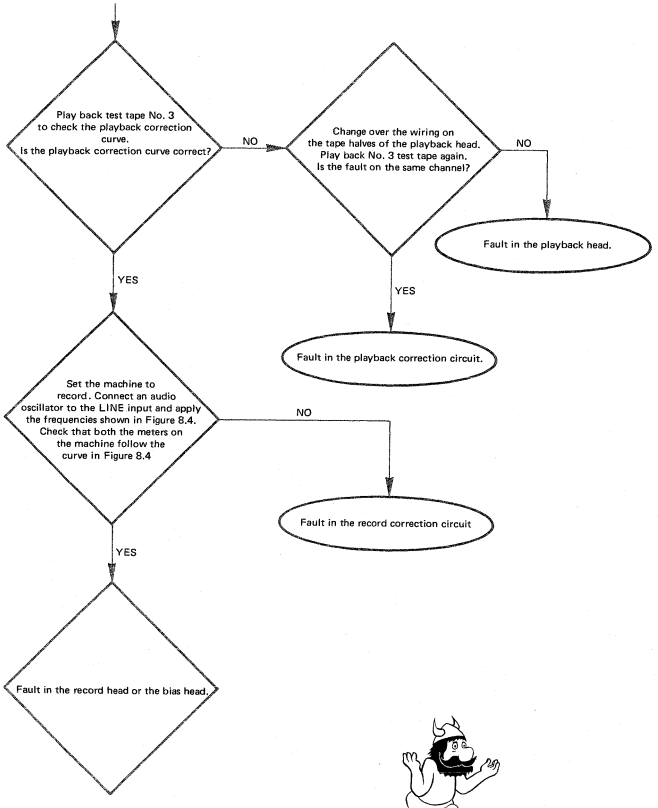


Fig. 8.6. Playback response curves.

8.4 FAULT IN THE TOTAL RESPONSE CURVE, ONE CHANNEL


Play back test tape No. 3 to check the playback correction curve. Is the playback correction curve correct?
NO
Change over the wiring on the tape halves of the playback head. Play back No. 3 test tape again. Is the fault on the same channel?
NO
Fault in the playback head.
YES
YES
Fault in the playback correction circuit.
Set the machine to record. Connect an audio oscillator to the LINE input and apply the frequencies shown in Figure 8.4. Check that both the meters on the machine follow the curve in Figure 8.4
NO
Fault in the record correction circuit
YES
Fault in the record head or the bias head.

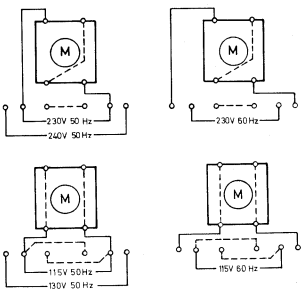
9.0 MODIFICATIONS

9.1 CHANGING THE LINE VOLTAGE AND FREQUENCY

A label on the motor shows you how to wire the transformer and motor for a different line voltage and frequency.

When modifying from 50 Hz to 60 Hz, or vice versa, the motor pulley has to be changed.

Motor pulley for 50 Hz, ordering No. 243940C
Motor pulley for 60 Hz, ordering No. 273787



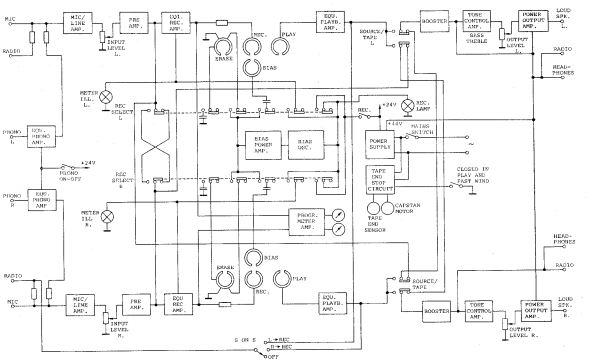
9.2 CHANGING FROM FOUR-TRACK TO TWO-TRACK VERSION

The following parts must be changed when a four-track version is modified to a two-track version and when new heads are fitted.
The value of the total capacitance is labelled on the heads.

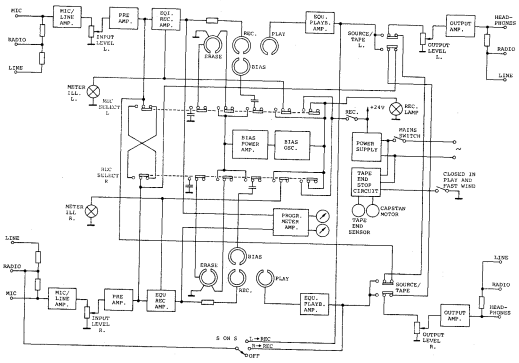
Part	Four track	Two track
Record head	F53-11R	F82-07R
Playback head	C03-10P	F83-11P
Erase head	D84-11E	D87-20E
Bias head	2079-03B	2958-04B
R136	3.9 k ohms	2.7 k ohms
R236	3.9 k ohms	2.7 k ohms
C400	3300 pF*	3300 pF*
C401	3300 pF*	3300 pF*
C402	250 pF*	250 pF*
C403	250 pF*	250 pF*

* Capacitor must be connected in parallel until value of total capacistance is achieved.

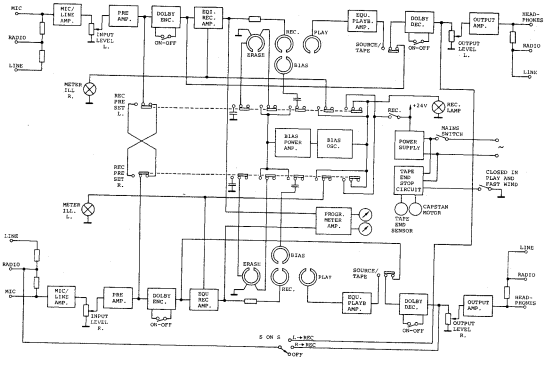
10. BLOCK DIAGRAMS



BLOCK DIAGRAM TB 3400X



BLOCK DIAGRAM TB 3500X



BLOCK DIAGRAM TB 3600XD

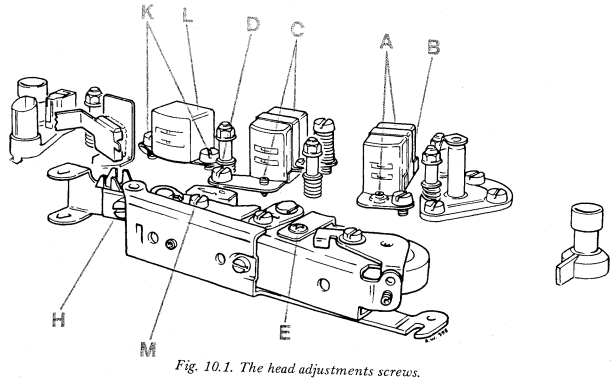


Fig. 10.1. The head adjustments screws.

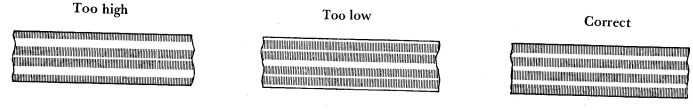


Fig. 10.2. Track measurement, four track record head.

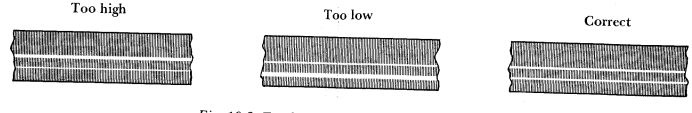


Fig. 10.3. Track measurement, four track erase head.

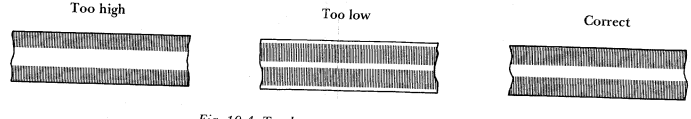


Fig. 10.4. Track measurement, two track record head.

11. ELECTRICAL ADJUSTMENTS

11.1 OUTPUT AMFLIFIERS (3400X).

Quiescent Current and Symmetrical Clipping (3400X)

The amplifier symmetry (balance) is determined by fixed components and by d.c. feedbak to stabilize the circuits against temperature variations. Therefore in general it will not be necessary to alter any component values.

Determine the quiescent current by measuring the voltage across emitter resistors R813 and R814 (R913 and R914) using a d.c. voltmeter.

Adjust R808 (R908) to a meter reading of approx. 17 mV giving a quiescent current of 30 mA.

Check the symmetry (balance) with an oscilloscope connected in parallel with a 4 ohm resistor to the LOUDSPEAKER outputs position 2, external speaker only. Apply a 400 Hz signal to the amplifier input and increase the input voltage until clipping is observed on the oscilloscope.

The clipping should be symmetrical and should occur at an output voltage of 7.7 V (corresponds to 15 W in 4 ohms).

Another method for checking the balance is to measure at the junction between the emitter resistors R813 and R814 (R913 and R914). When the symmetry is correct, the voltage is half the supply voltage. The balance can be adjusted by altering the value of the resistors R800 (R900) or R801 (R901). If these resistors have to be altered drastically, it is an indication of some other kind of fault in the amplifier.

Checking the Distortion (3400X)

The maximum permissible distortion from the output amplifier at full output power is 1%. To check the distortion, connect a distortion meter and an a.c. voltmeter in parallel across the LOUDSPEAKER output, position 2, for the channel in question. The output must be loaded with a 4 ohm resistor.

Feed a 400 Hz signal to the RADIO input when the recorder is set in the amplifier mode.

Increase the level of the input signal so that the output a.c. voltmeter indicates 7.7 V (15 W in 4 ohms). The distortion should not exceed 1%.

Tone Controls (3400X)

Connect an a.c. voltmeter to each of the LOUDSPEAKER outputs, position 2 (external speaker only) and set the recorder in the stereo amplifier mode (none of the function selector button depressed). depressed).

Set the tone controls to their centre positions and feed a 1000 Hz signal to the RADIO inputs. Set the INPUT LEVEL and OUTPUT LEVEL controls to obtain an output level of approximately 200 mV. Use the reading as 0 dB reference and alter the frequency to check that the bass control has ± 15 dB range at 100 Hz. Check the treble response to be ± 15 dB at 10,000 Hz.

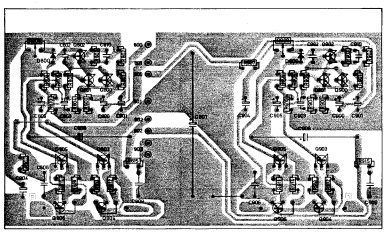


Fig. 11.1 Adjustments points on the output board

11.2 DOLBY LEVEL ADJUSTMENETS (3600XD).

NOTE! When ordering integrated circuits for the Dolby Board, specify the colour marked on the IC terminal legs by our factory.
The colour code corresponds to the frequency response of the IC, and the same colour should be used on one board. The colours are Black, Blue and Orange.

Dolby playback level

Play back a Tandberg Test Tape No. 25 or an Ampex, Operating level tape. Set the Dolby switch to OFF and the OUTPUT LEVEL to max. (at 7½ ips).

Connect a VVM to the LINE OUT socket and adjust the PLAYBACK ADJ. pots. R66 (L) and R166 (R) to obtain 570 mV on the VVM. This voltage corresponds to 580 mV on the Dolby decoder output pins 612 and 614 on the Dolby board.

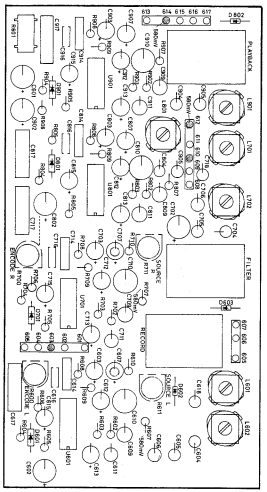


Fig. 11.2 Adjustments and measurement points on the Dolby Board

Dolby levels

The pots. on the Dolby board are adjusted at the factory and sealed.

Calibrate as follows:
Set the SOURCE/TAPE buttons to SOURCE. Connect an audio sig.generator at 1000 Hz to the LINE INPUT socket. Connect a VVM to points 603 (L) and 610 (R) on the Dolby board and adjust the INPUT LEVEL controls to obtain 50 mV. Connect the VVM to the negative (case) side of C607/C707 and adjust R600 (L) and R700 (R) to obtain 580 mV. Connect the VVM to pins 612 (L) and 614 (R) and adjust R611 (L) and R711 (R) to obtain 580 mV.

SOURCE/TAPE and level meter adjustment

Load the deck with a high quality tape e.g. Tandberg LH tape. Connect an audio sig.generator at 1000 Hz to the LINE IN socket. Put the deck into the stereo record mode and set the SOURCE/TAPE button to SOURCE and the OUTPUT LEVEL controls to max. Adjust the INPUT LEVEL controls to obtain 1 V on a VVM connected to the LINE OUT socket.

Set the SOURCE/TAPE button to TAPE and adjust R112 (L) and R212 (R) to obtain 1.15 V at the LINE OUT socket.

Finally, adjust the level meters to indicate 0 dB by means of R137 (L) and R237 (R).

GENERAL

Make the adjustment in the order which they are listed here. Many of the adjustments require that previous adjustment have already been correctly made. Use L.H. tape.

Clean and degauss the tape path before and after the adjustments. It is assumed that the tape path has already been correctly adjusted as described on pages 11, 12, 13, 14, 15, and 16.

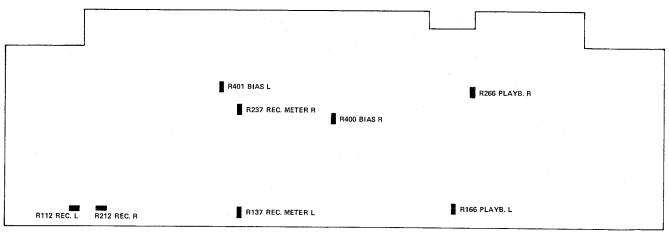
Necessary equipment

- 2 high impedance voltmeters
- Frequency counter
- Audio generator
- Distortion meter
- Tandberg test tapes

No. 2 Azimuth adj. playb. head
No. 3 Playb. curve DIN 19H
No. 4 Playb. level adj.
No. 11 Speed check 1000 Hz. 7½ ips.
No. 25 Dolby level adj. 700 Hz. 7½ ips.
Tandberg L.H. tape or equivalent.

Test No.	Adjustment or check	Test tape No.	Set the deck to	Measuring instrument	Measure at	Adjust	Correct reading	Dolby Speed	Dolby switch	Comments
1.1	Playback head, Azimuth	2	Playback	Voltmeters	LINE OUT	Screw B Figure 10.1 page 21	See comments	7½ ips	OFF	Maximum output or best compromise
1.2	Playback curve	3	Playback	Voltmeters	LINE OUT		± 2.5 dB from the referance	7½ ips	OFF	Playback curve: N.A.B. or DIN 19H.
1.3	Playback level	4	Playback	Voltmeters	LINE OUT	R166 and R266	1.0 V	7½ ips	OFF	
1.4	Dolby playback level 3600XD	25	Playback	Voltmeters	LINE OUT	R166 and R266	570 mV	7½ ips	OFF	This level corresponds to 580 mV on Dolby decoder output, pins 612 and 614 on the Dolby board.
1.5	Speed check	11	Playback	Frequency counter	LINE OUT	See comments	1000 Hz ± 1% 990 Hz to 1010 Hz)	7½ ips	OFF	The tape is recorded at 1000 Hz and 7½ ips. To correct the tape speed fit a drive wheel with a different diameter.
1.6	Bias, pre-adjustments		Record	Voltmeter	Measure across the bias head	R401 and R400	22 V	7½ ips	OFF	To be performed without tape

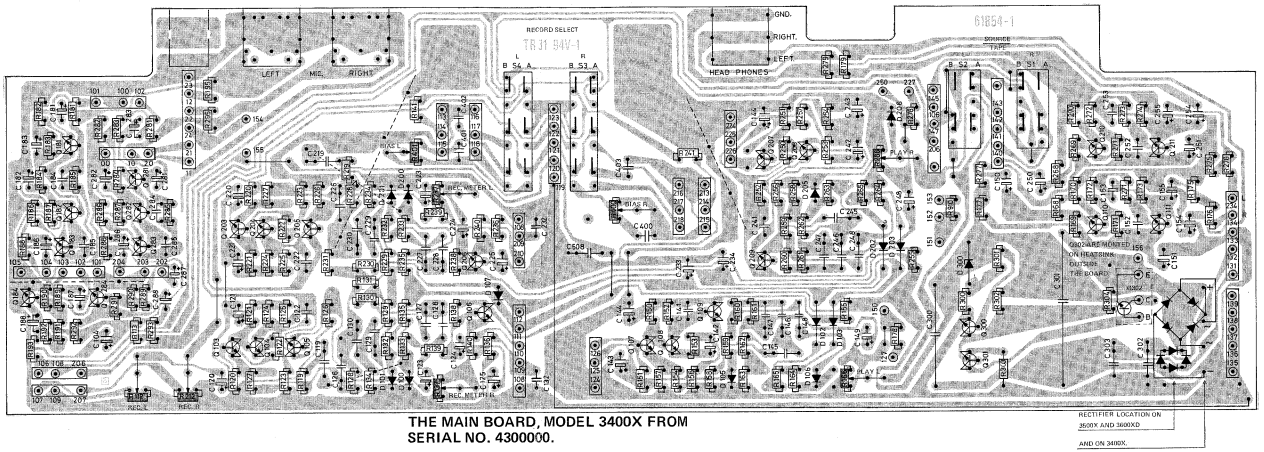
Adjustment table 1.



Location of adjustable components on the Main board. Seen from the solder side, all models

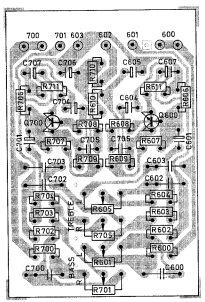
No.	Adjustment or check	Tape	Measuring instrument	Measure at	Dolby* switch	SOURCE/ TAPE switch	Set the deck to	Procedure:
2.1	Bias head, Horizontal adjustment	L.H. tape	Voltmeters	LINE OUT	OFF	TAPE	RECORD 7½ ips	Connect an audio signal generator to the LINE IN socket. Set the generator to 1000 Hz, 0.5 V. Set the OUTPUT LEVEL knobs on the deck to maximum. Adjust the INPUT LEVEL knobs on the deck for 75 mV deflection on the voltmeters. Adjust R401 for maximum deflection on the left channel voltmeter and R400 for maximum deflection on the right channel voltmeter.
2.2	Record head, Azimuth	L.H. tape	Voltmeters	LINE OUT	OFF	TAPE	RECORD 3¾ ips	Connect an audio signal generator to the LINE IN sockets. Start stereo recording at 3¾ ips with a 400 Hz signal 30 dB below normal recording level (0 dB). Switch the generator to 16,000 Hz and adjust the azimuth screw D, Figure 10.1 for maximum deflection on the voltmeters.
2.3	Record/ playback curves	L.H. tape	Voltmeters	LINE OUT	OFF	TAPE	RECORD all speeds	Connect an audio signal generator to the LINE IN sockets. Start stereo recording at 3¾ ips with a 1000 Hz signal 30 dB below normal recording level (0 dB). Use the voltmeter readings as referance level. Switch the generator to 18,000 Hz and check that the output is within ± 2 dB of the referance level. If the output is too high, increase the bias current with R401 (L) and R400 (R). If the output is too low alter the signal generator to 1000 Hz and adjust for maximum output with R401 (L) and R400 (R). Then establish a referance level at 1000 Hz and re-check the output at 18,000 Hz. When tolerance at 18,000 Hz has been met, check that the output level does not deviate more than ± 2 dB from the referance level over the following frequency ranges: 7½ ips – 30-22,000 Hz 3¾ ips 40-18,000 Hz 1 7/8 ips – 40-9,000 Hz 3600XD When you switch the Dolby knob from OFF to NORM, check that the output level does not deviate more than ± 3 dB.
2.4	SOURCE/ TAPE adjustment and REC METER adjustment	L.H. tape	Voltmeters	LINE OUT	OFF	SOURCE/ TAPE	RECORD 7½ ips	Connect an audio signal generator to the LINE IN sockets. Load the recorder with an L.H. tape and record in stereo a 400 Hz signal ay at 7½ ips leaving the SOURCE/TAPE buttons in position SOURCE. Adjust the INPUT LEVEL controls on the deck for a voltmeter deflection of 1 V at both outputs. Depress SOURCE/TAPE buttons and adjust R112 (L) and R212 (R) for 1.25 V reading on the voltmeter. Adjust R137 to 0 dB reading on the left record meter and R237 for the same reading on the right record meter.
2.5	SOURCE/ TAPE adjustment 3600XD	L.H. tape	Voltmeters	LINE OUT	OFF	SOURCE/ TAPE	RECORD 7½ ips	NOTE! Potentiometers on the Dolby board are adjusted at the factory and sealed. If re-calibration is necessary, see page 22. Connect an audio signal generator (1000 Hz) to the LINE IN sockets. Set the deck to stereo record. Press the SOURCE button. Adjust the INPUT LEVEL controls on the deck for 1 V at the LINE OUTPUT. Set the deck to TAPE and adjust the level at the LINE OUTPUT to 1.15 V with R112 (L) and R212 (R). Then adjust the record meters to 0 dB with R137 (L) and R237 (R).
2.6	Distortion	L.H. tape	Distortion meter	LINE OUT	OFF	TAPE	RECORD 7½ ips	Connect an audio signal generator (or distortion meter generator) Set to 1000 Hz to the LINE IN sockets. Record with 0 dB indication on the meters and read the distortion at the LINE OUT sockets. Maximum distortion is 3%.
2.7	Wow and flutter	L.H. tape	Wow and flutter meter	LINE OUT	OFF T	TAPE	RECORD all speeds	Connect the wow and flutter meter to the LINE IN sockets. Read the wow and flutter meter at the LINE OUT sockets and at all speeds. Wow and flutter max.: 7½ ips 3¾ ips 1 7/8 ips Peak, DIN 45511 0.1 % 0.18 % 0.55 % Weighted R.M.S. 0.07 % 0.12 % 0.25 %

Adjustment table 2.

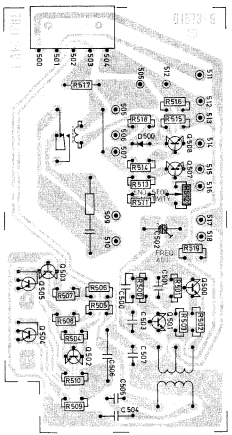


THE MAIN BOARD, MODEL 3400X FROM SERIAL NO. 4300000.

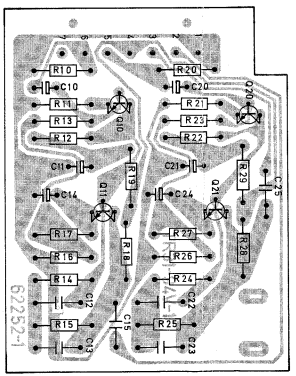
All the boards are seen from the solder side.



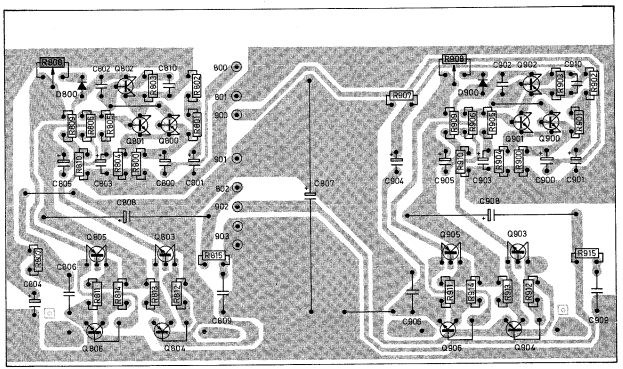
TONE CONTROL AMP



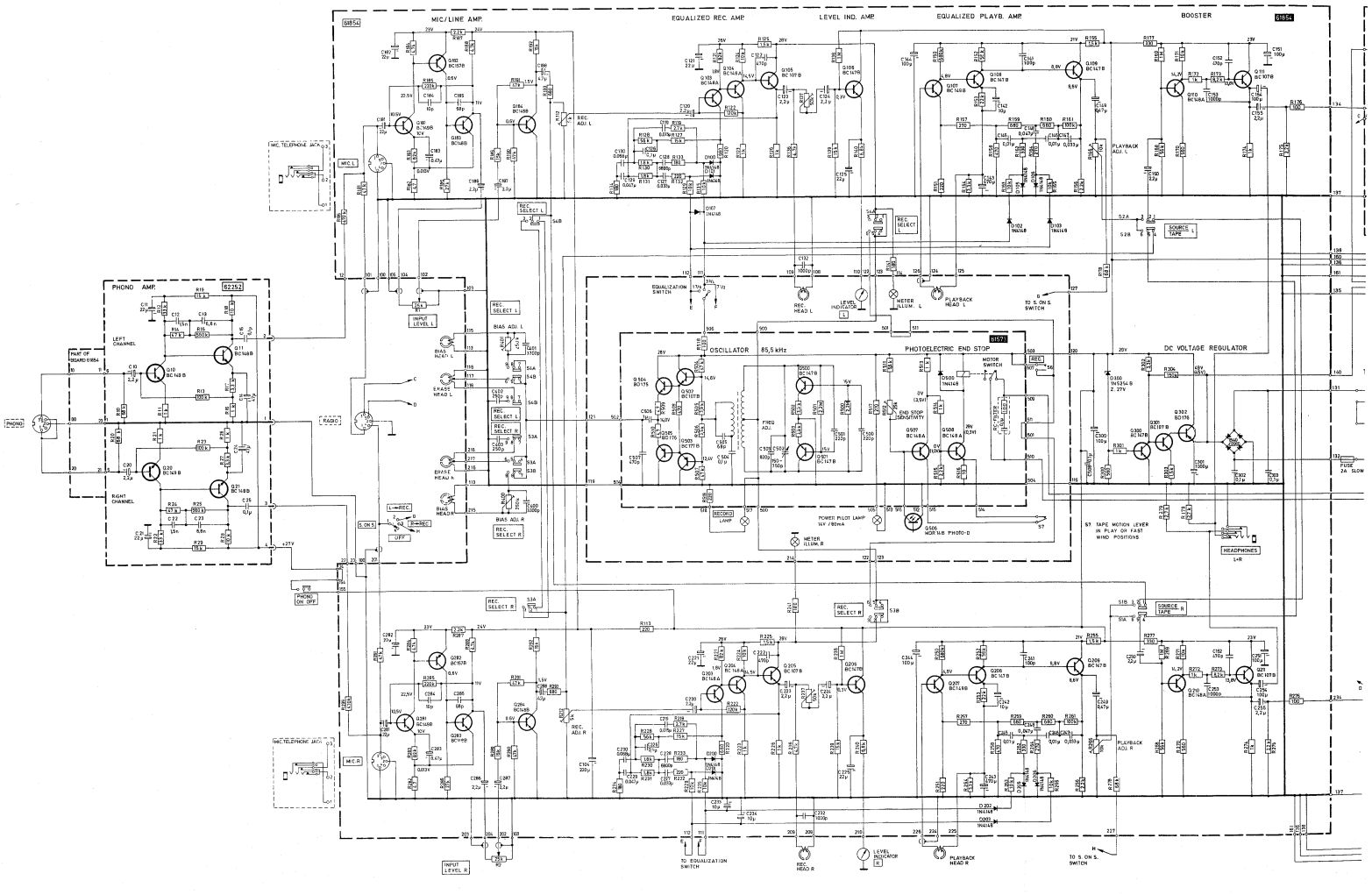
OSCILLATOR

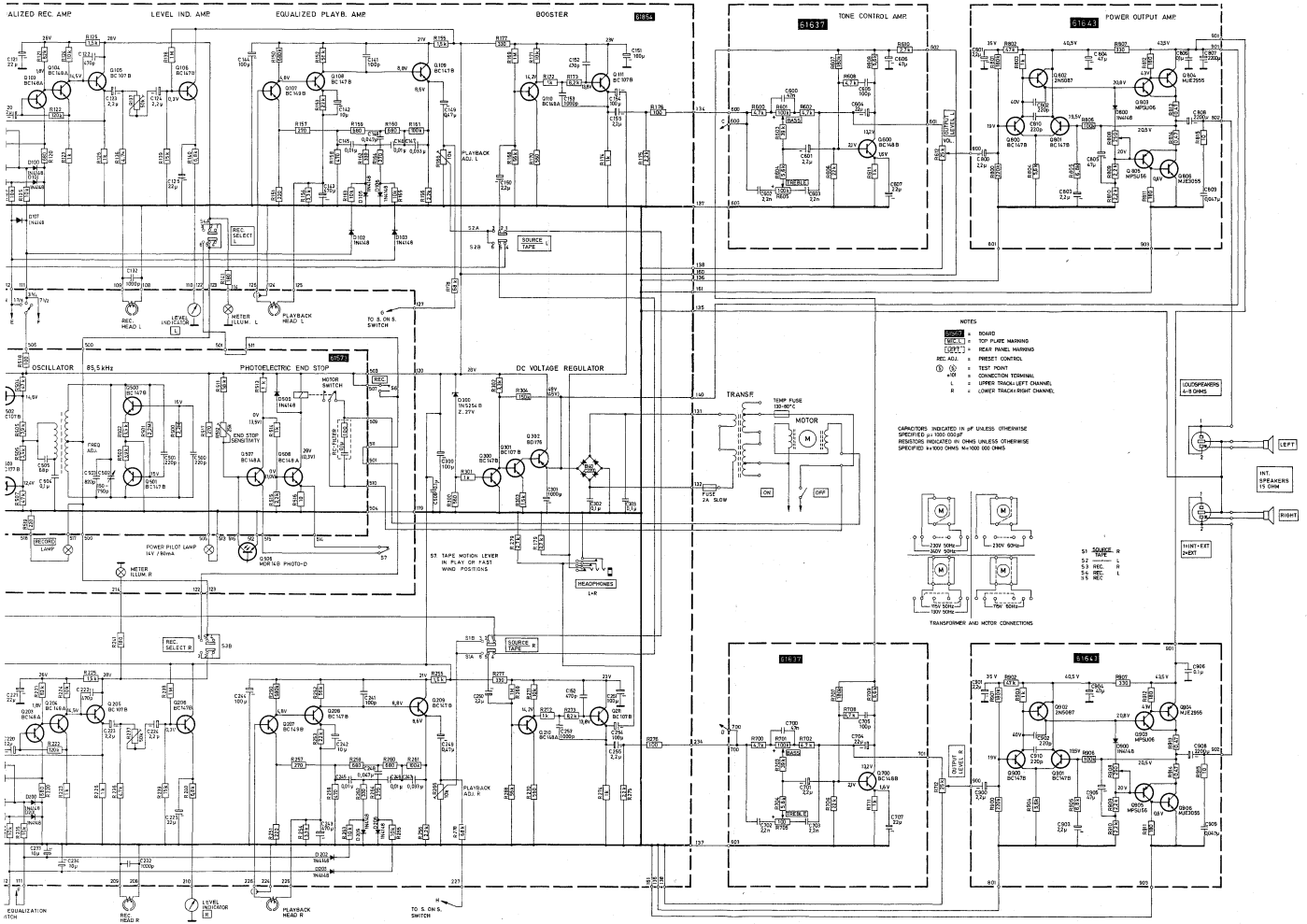


PHONO AMP

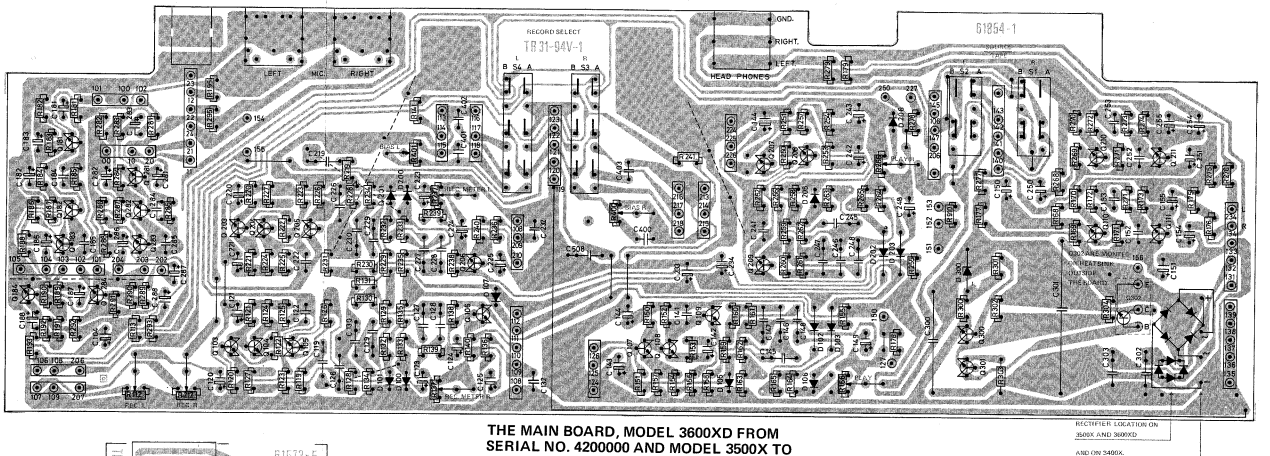


POWER OUTPUT AMP

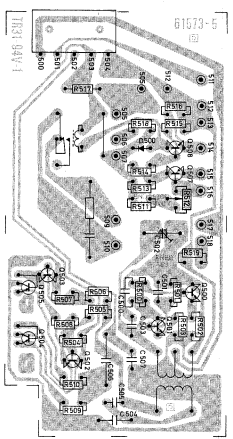

MIC/LINE AMP.
EQUALIZED REC. AMP.
LEVEL IND. AMP.
EQUALIZED PLAYB. AMP.
BOOSTER
6854
PHONO AMP.
R2252
PART OF SOUND 6854
LEFT CHANNEL
RIGHT CHANNEL
PHONO
RADIO
MIC. TELEPHONE JACK
MIC. L
MIC. R
REC. ADJ. L
REC. ADJ. R
REC. SELECT L
REC. SELECT R
INPUT LEVEL L
INPUT LEVEL R
BIAS ADJ. L
BIAS ADJ. R
ERASE HEAD L
ERASE HEAD R
L→REC
R→REC
OFF
S ON S
PHONO ON-OFF
+27V
OSCILLATOR
85,5 kHz
PHOTOELECTRIC END STOP
6871
EQUALIZATION SWITCH
REC. HEAD L
LEVEL INDICATOR L
METER ILLUM. L
PLAYBACK HEAD L
TO S. ON S. SWITCH
PLAYBACK ADJ. L
SOURCE TAPE L
MOTOR SWITCH
REC
END STOP SENSITIVITY
RECORD LOOP
POWER PILOT LAMP 14V / 60mA
METER ILLUM. R
G506 NORLED PHOTO-D
DC VOLTAGE REGULATOR
S7 TAPE MOTION LEVER IN PLAY OR FAST WIND POSITIONS
HEADPHONES L+R
FUSE 2A SLOW
TO EQUALIZATION SWITCH
REC. HEAD R
LEVEL INDICATOR R
PLAYBACK HEAD R
TO S. ON S. SWITCH
PLAYBACK ADJ. R
SOURCE TAPE R



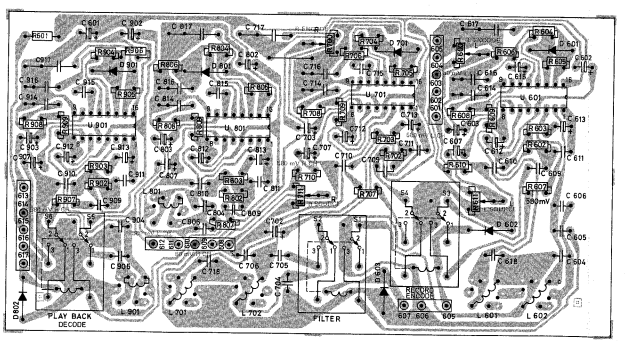
CIRCUIT DIAGRAM 3400X



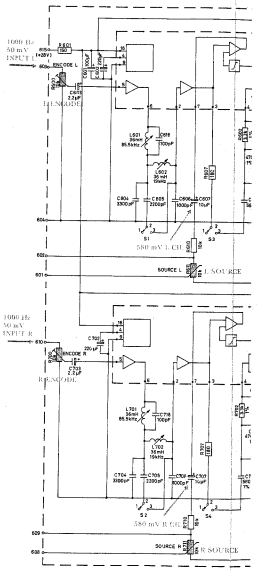
THE MAIN BOARD, MODEL 3600XD FROM SERIAL NO. 4200000 AND MODEL 3500X TO SERIAL NO. 4009900.

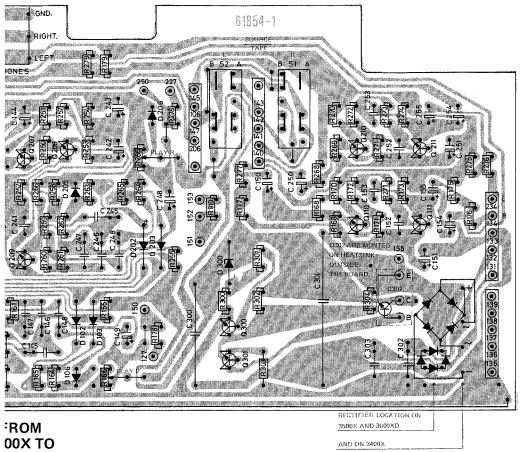


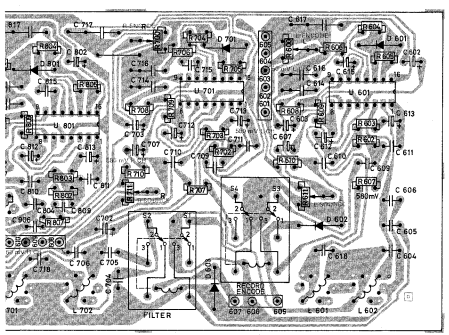
OSCILLATOR



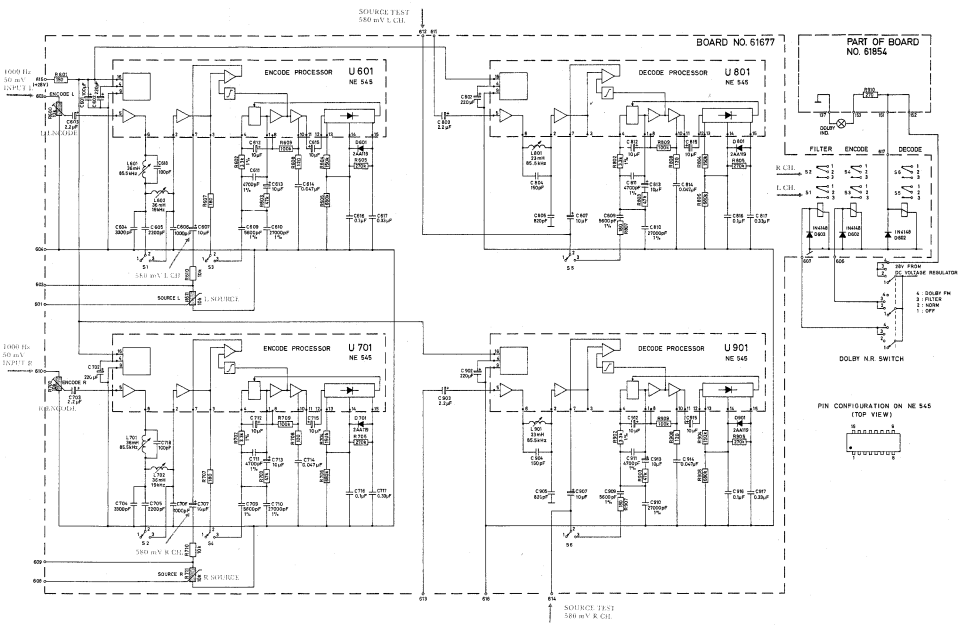
DOLBY BOARD



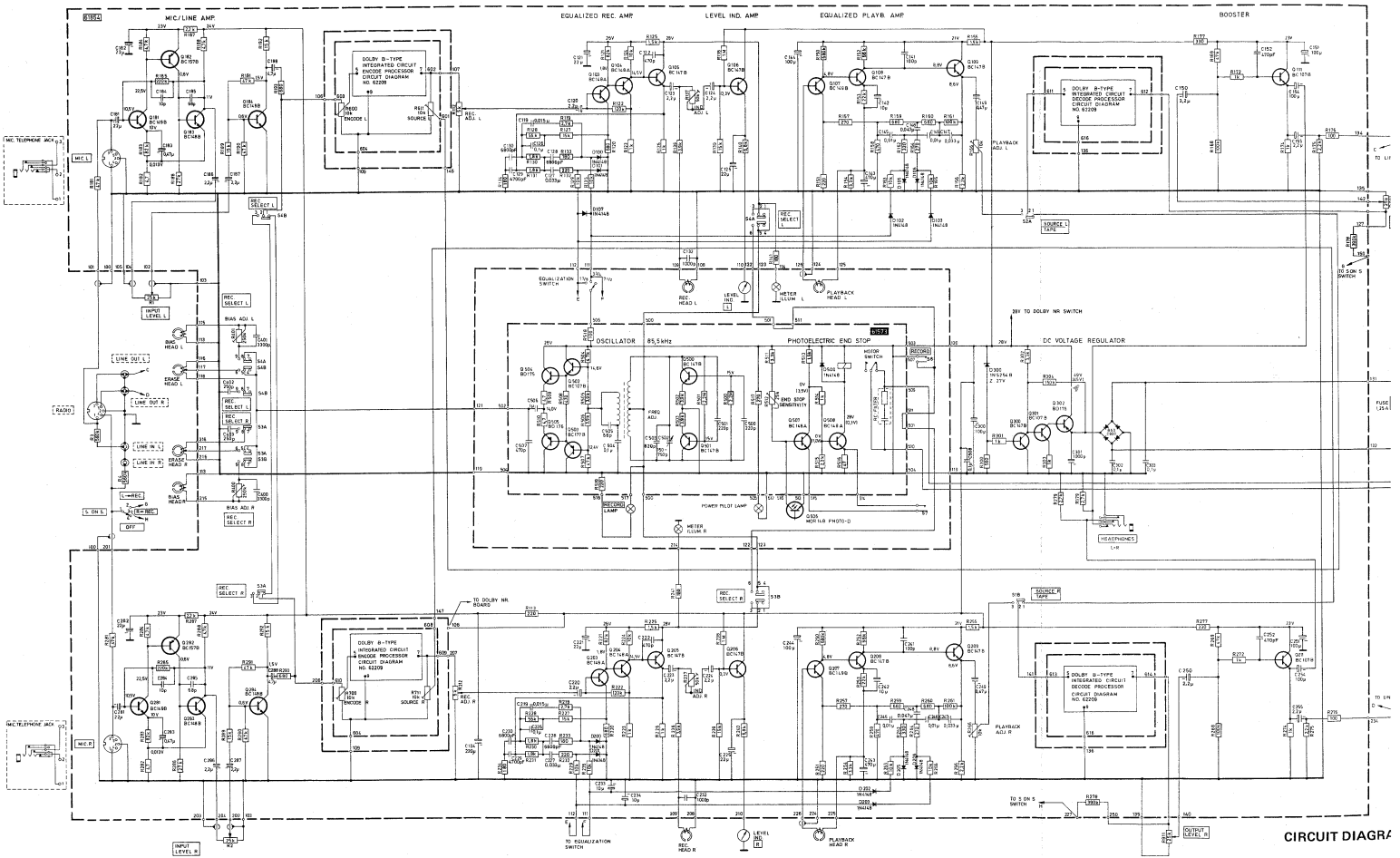


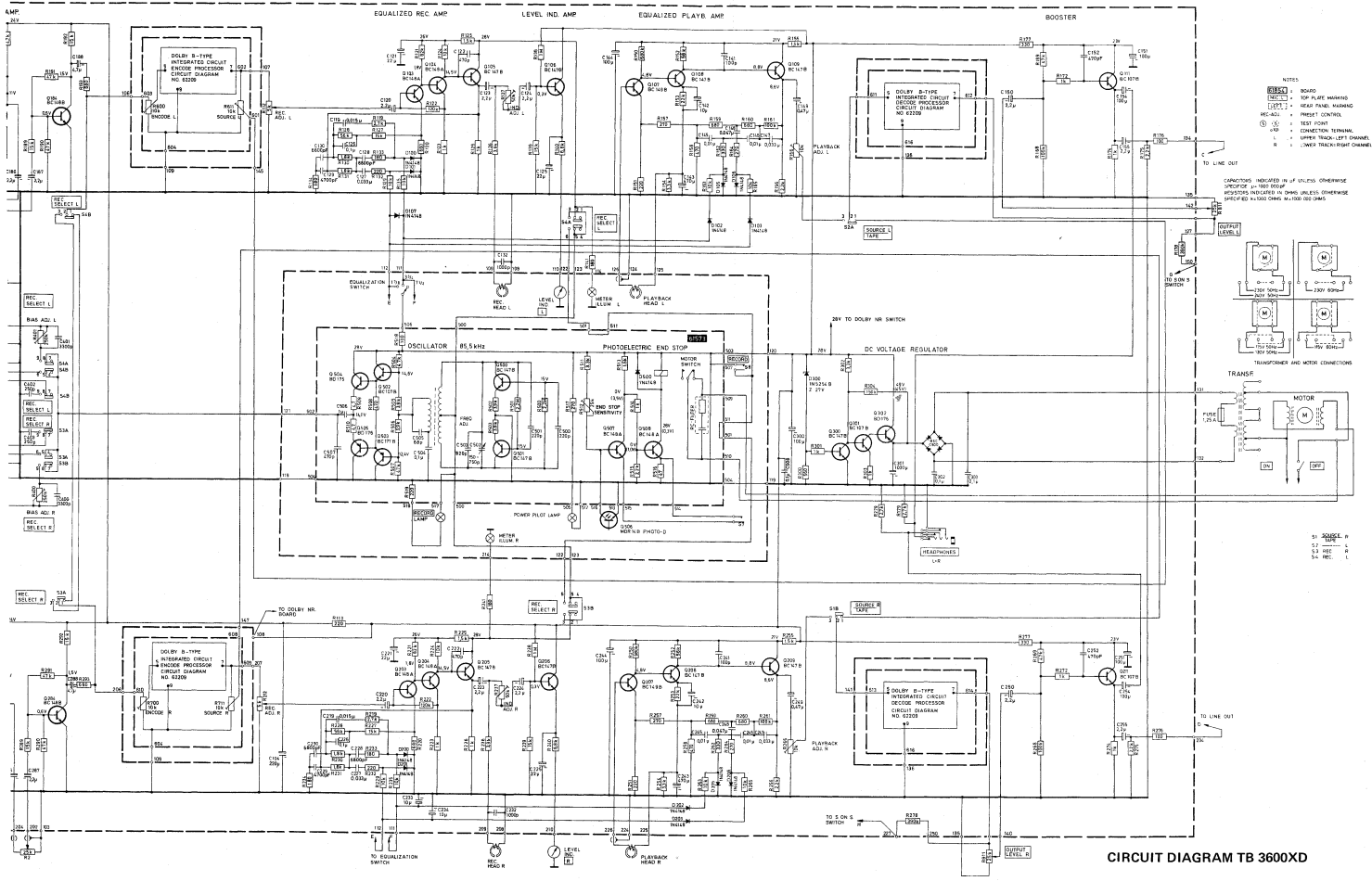


DOLBY BOARD

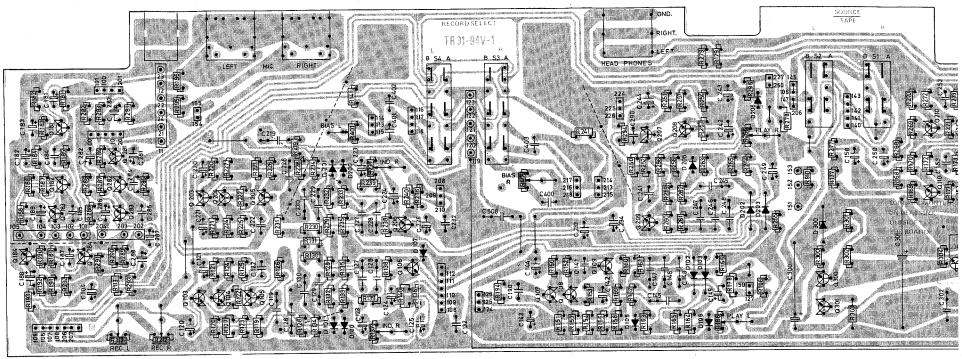


DOLBY CIRCUIT, MODEL 3600XD

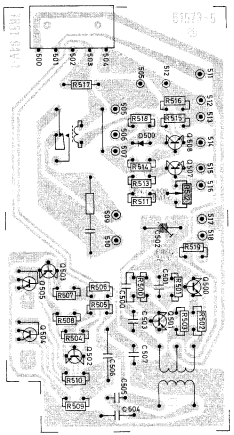

MIC/LINE AMP
EQUALIZED REC. AMP
LEVEL IND. AMP
EQUALIZED PLAYB. AMP
BOOSTER
DOLBY B-TYPE INTEGRATED CIRCUIT ENCODE PROCESSOR CIRCUIT DIAGRAM NO. 62209
DOLBY B-TYPE INTEGRATED CIRCUIT DECODE PROCESSOR CIRCUIT DIAGRAM NO. 62209
OSCILLATOR 85.5kHz
PHOTOELECTRIC END STOP
DC VOLTAGE REGULATOR
MIC TELEPHONE JACK
MIC L
MIC R
REC SELECT L
REC SELECT R
INPUT LEVEL L
INPUT LEVEL R
BIAS ADJ. L
BIAS ADJ. R
BIAS HEAD L
BIAS HEAD R
ERASE HEAD L
ERASE HEAD R
LINE OUT L
LINE OUT R
LINE IN L
LINE IN R
RADIO
S ON S
L-REC
R-REC
OFF
REC ADJ. L
REC ADJ. R
PLAYBACK ADJ. L
PLAYBACK ADJ. R
SOURCE L TAPE
SOURCE R TAPE
TO DOLBY NR BOARD
TO DOLBY NR SWITCH
TO S ON S SWITCH
EQUALIZATION SWITCH
REC HEAD L
REC HEAD R
PLAYBACK HEAD L
PLAYBACK HEAD R
LEVEL IND. L
LEVEL IND. R
METER ILLUM L
METER ILLUM R
POWER PILOT LAMP
RECORD LAMP
MOTOR SWITCH
END STOP SENSITIVITY
HEADPHONES
OUTPUT LEVEL R
TO LINE
CIRCUIT DIAGRA


EQUALIZED REC. AMP
LEVEL IND. AMP
EQUALIZED PLAYB. AMP
BOOSTER
DOLBY B-TYPE INTEGRATED CIRCUIT ENCODE PROCESSOR CIRCUIT DIAGRAM NO. 62208
DOLBY B-TYPE INTEGRATED CIRCUIT DECODE PROCESSOR CIRCUIT DIAGRAM NO. 62209
OSCILLATOR 85,5 kHz
PHOTOELECTRIC END STOP
DC VOLTAGE REGULATOR
TRANSF
MOTOR
TO LINE OUT
TO DOLBY NR BOARD
TO EQUALIZATION SWITCH
TO S ON S SWITCH
TRANSFORMER AND MOTOR CONNECTIONS
CAPACITORS INDICATED IN pF UNLESS OTHERWISE SPECIFIED µ=1000 000pF
RESISTORS INDICATED IN OHMS UNLESS OTHERWISE SPECIFIED K=1000 OHMS M=1000 000 OHMS

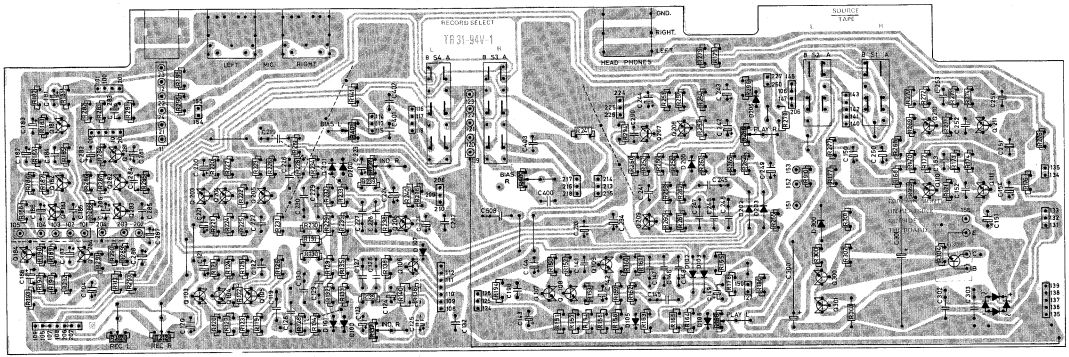
CIRCUIT DIAGRAM TB 3600XD



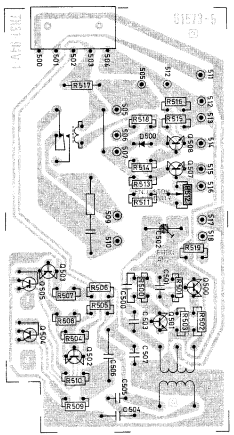
THE MAIN BOARD, MODEL 3500X FROM SERIAL NO. 4009900. SERIAL NO. BELOW, SEE PAGE 26.



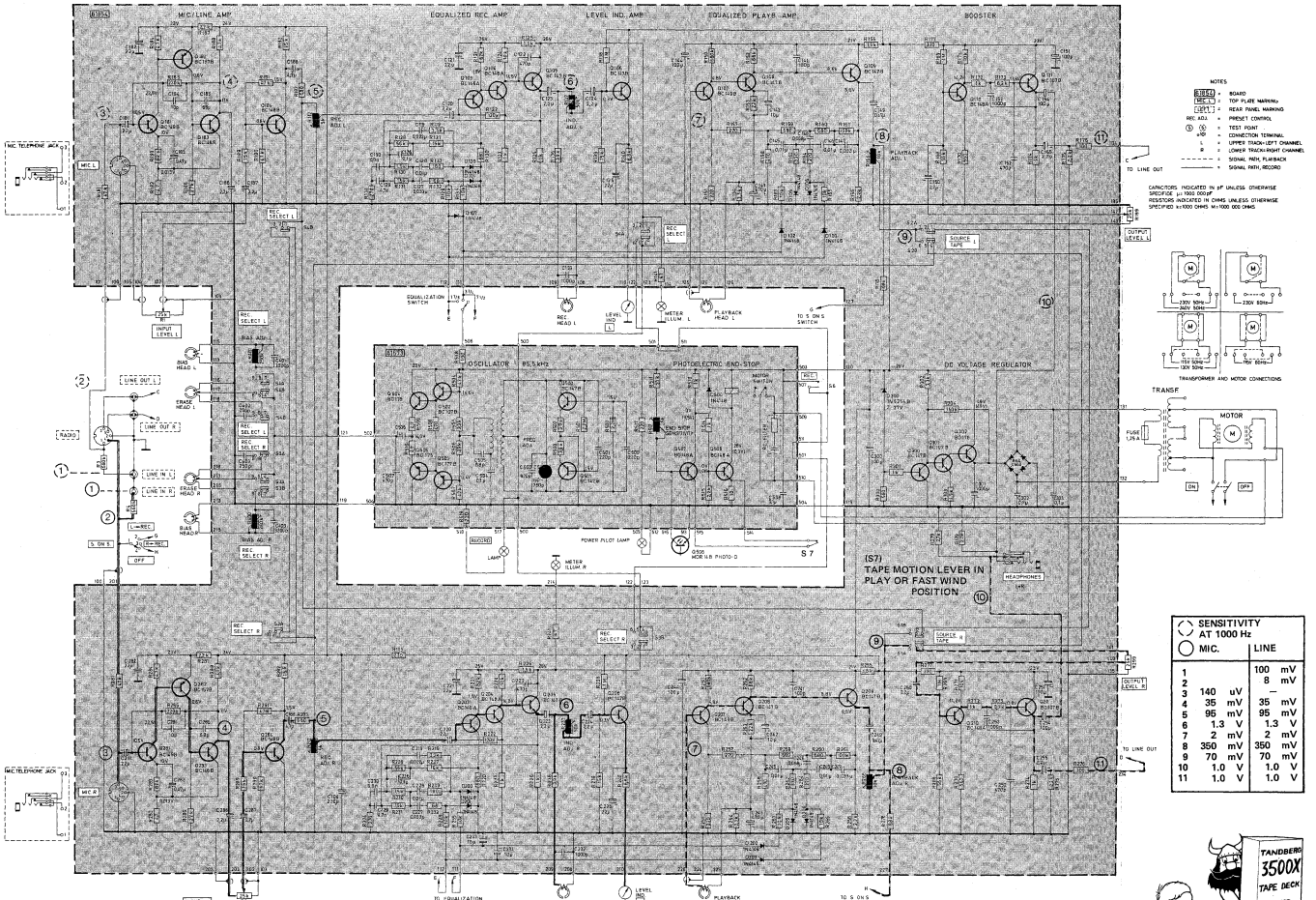
OSCILLATOR



THE MAIN BOARD, MODEL 3500X FROM SERIAL NO. 4009900. SERIAL NO. BELOW, SEE PAGE 26.



OSCILLATOR

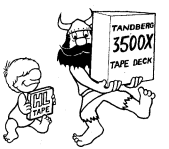


NOTES

B 352	=	BOARD
REC. L	=	TOP PLATE MARKING
SW 11	=	REAR PANEL MARKING
REC ADJ.	=	PRESET CONTROL
Ⓢ Ⓛ	=	TEST POINT
⊥	=	CONNECTION TERMINAL
L	=	UPPER TRACK=LEFT CHANNEL
R	=	LOWER TRACK=RIGHT CHANNEL
- - -	=	SIGNAL PATH, PLAYBACK
———	=	SIGNAL PATH, RECORD

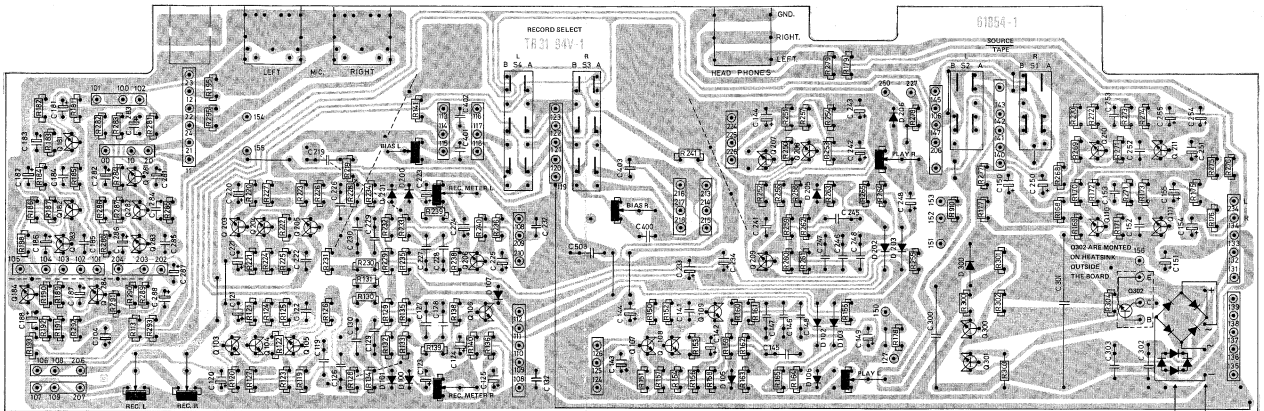
CAPACITORS INDICATED IN pF UNLESS OTHERWISE SPECIFIED µ=1000 000 pF
RESISTORS INDICATED IN OHMS UNLESS OTHERWISE SPECIFIED K=1000 OHMS M=1000 000 OHMS

SENSITIVITY AT 1000 Hz		
◯ MIC.		LINE
1		100 mV
2		8 mV
3	140 uV	–
4	35 mV	35 mV
5	95 mV	95 mV
6	1.3 V	1.3 V
7	2 mV	2 mV
8	350 mV	350 mV
9	70 mV	70 mV
10	1.0 V	1.0 V
11	1.0 V	1.0 V

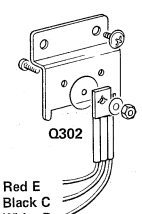


Circuit Diagram 3500X

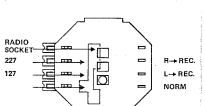
From Serial No. 4000479



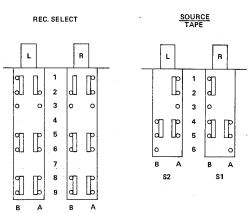
The Main Board with adjustment points and the symbolic component location. Seen from solder side.



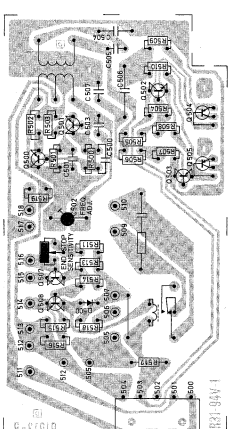
When replacing the transistor be sure to position the metal side against the mica washer.



Sound on Sound Switch
Seen from the rear.



Seen from solder side.

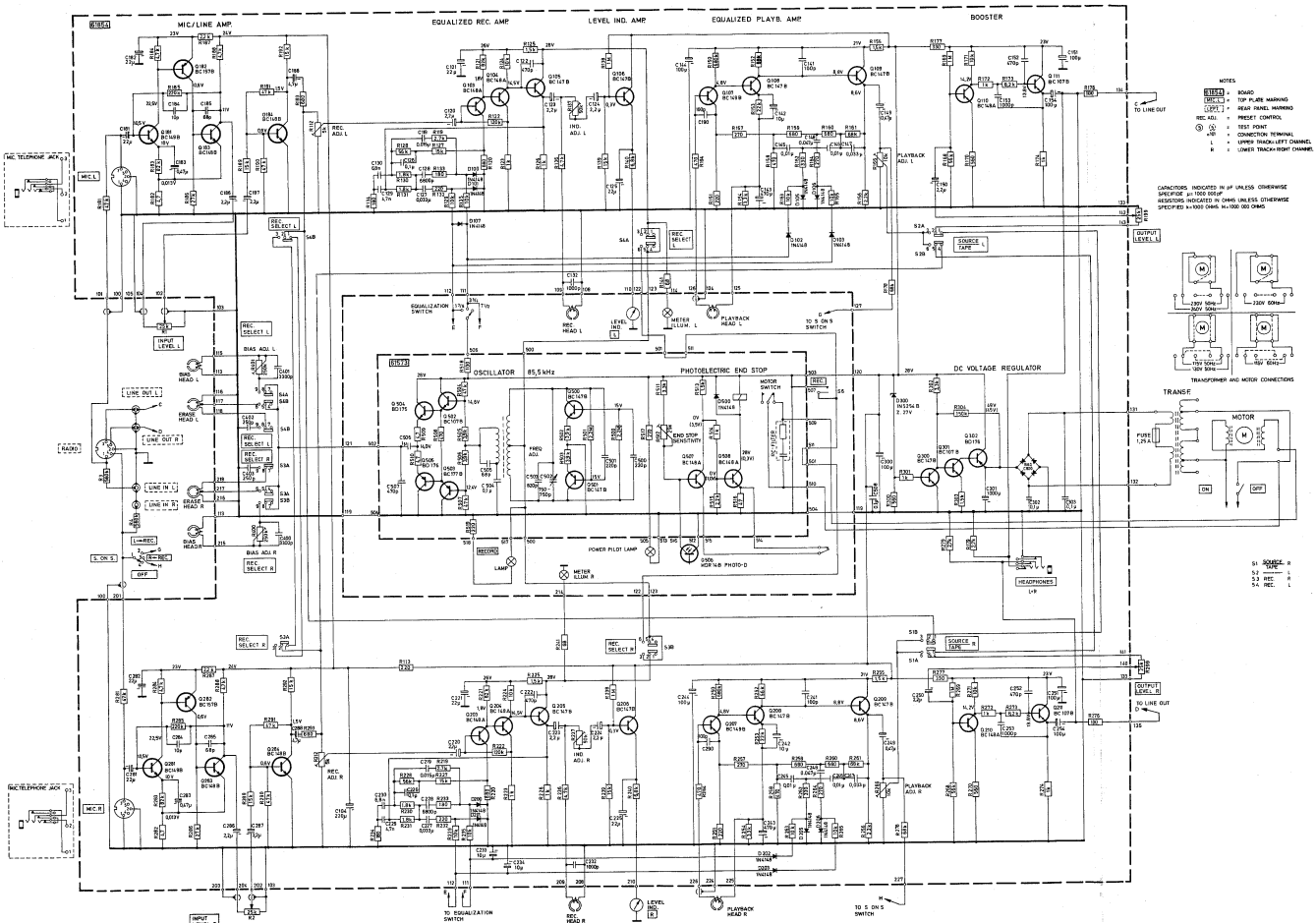


Board for oscillator, bias circuit and photoelectric end stop circuit. Seen from solder side.

Tandberg tape deck 3500X

From Serial No. 4000479

1220 - 2 - 75 Part No. 343032
Printed in Norway by Tøyen-Trykk



CIRCUIT DIAGRAM TB 3500X